Docket No.: YOR920030300US1
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Alfred Grill et al.

Application No.: 10/689,675 | Confirmation No.: 4901

Filed: October 22, 2003 | Art Unit: 1754

For: CONTROL OF CARBON NANOTUBE DIAMETER USING CVD OR PECVD GROWTH | Examiner: Johnson, Edward M.

REPLACEMENT APPEAL BRIEF

MS Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

As required under § 41.37(a), this replacement brief is filed in furtherance of said Notice of Appeal.

This brief contains items under the following headings as required by 37 C.F.R. § 41.37 and M.P.E.P. § 1205.2:

I. REAL PARTY IN INTEREST

The real party in interest for this appeal is:

International Business Machines Corporation

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

A. Total Number of Claims in Application

There are 20 claims pending in application.

B. Current Status of Claims

1. Claims canceled: 16-20
2. Claims withdrawn from consideration but not canceled: 0
3. Claims pending: 1-15
4. Claims allowed: 0
5. Claims rejected: 1-15

C. Claims On Appeal

The claims on appeal are claims 1-15

IV. STATUS OF AMENDMENTS

Applicant did not file an Amendment After Final Rejection.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The present invention as defined by claim 1 relates to a method for controlling the diameter of carbon nanotubes grown by chemical vapor deposition (CVD) or by plasma

enhanced chemical vapor deposition(PECVD) in the range of about 0.2 to about 100 nanometers (see, for example, page 4, lines 3-5 of the specification). The method comprises:

introducing a catalyst substrate into a CVD OR PECVD growth reactor (see, for example, page 4, line 16 of the specification);

increasing the growth reactor temperature to a desired growth temperature (see, for example, page 4, line 17 of the specification).;

flowing reactive gases including a carbon containing precursor (see, for example, page 4, line 18 of the specification).; and

controlling the residence time of the carbon containing precursor in the reactor to control the diameter of the carbon nanotubes (see, for example, page 4, lines 10-11 of the specification and Figures 1A, 1B, 2A and 2B).

Claim 2 further recites that the residence time of the carbon containing precursor in the reactor is controlled by establishing a controlled pressure in the reaction chamber and adjusting the gas flow rate of the carbon precursor (see, for example, page 4, lines 19-22 of the specification).

Claim 3 further recites that the residence time of the carbon containing precursor in the reactor is controlled by establishing controlled gas flow rates into the reactor and adjusting the pressure in the reactor (see, for example, page 4, lines 25-26 of the specification).

Claim 4 further recites that the residence time of the carbon containing precursor in the reactor is controlled by adjusting the gas flow rate and the growth pressure of the reactor (see, for example, page 4, lines 21-24 of the specification).

Claim 5 further recites that the growth temperature is about 400 to about 1200°C (see, for example, page 7, lines 13 of the specification).

Claim 6 further recites that the catalyst substrate contains transition metal particles (see, for example, page 7, line 1 of the specification).

Claim 7 further recites that the catalyst comprises at least one member selected from the group consisting of Fe, Mo, Co, Ni, Ti, Cr, Ru, Mn, Re, Rh, Pd, V and alloys thereof (see, for example, page 7, lines 1-2 of the specification).

Claim 8 further recites that the catalyst substrate have a size about 0.2 nanometers to about 100 nanometers (see, for example, page 14, lines 3-4 of the specification).

Claim 9 further recites that the carbon containing precursor comprises at least one member selected from the group consisting of aliphatic hydrocarbons, aromatic hydrocarbons, carbonyls, halogenated hydrocarbons, silyated hydrocarbons, alcohols, ethers, aldehydes, ketones, acids, phenols, esters, amines, alkylnitrile, thioethers, cyanates, nitroalkyl, alkylnitrate, and mixtures thereof (see, for example, page 7, lines 14-20 of the specification).

Claim 10 further recites that the carbon containing precursor comprises at least one member selected from the group consisting of methane, ethane, propane, butane, ethylene, acetylene, carbon monoxide and benzene (see, for example, page 7, lines 19-20 of the specification).

Claim 11 further recites employing a carrier gas along with the carbon precursor (see, for example, page 7, lines 20-22 of the specification).

Claim 12 further recites that the carrier gas comprises at least one member selected from the group consisting of argon, nitrogen, helium, hydrogen and ammonium (see, for example, page 7, lines 20-22 of the specification).

Claim 13 further recites that the flow rate or pressure or both is adjusted such that the residence time in the reactor can be varied from about 1 minute to about 20 minutes, to tune the CNT diameter (see, for example, page 7, lines 22-28 of the specification).

Claim 14 further recites that the flow rate or pressure or both is adjusted so that the residence time can be varied between about 1.2 minutes to about 10 minutes to tune the CNT diameter (see, for example, page 7, lines 22-28 of the specification).

Claim 15 further recites that the diameter of the carbon nanotubes is smaller than the particle size of the catalyst (see, for example, page 6, lines 14-15 of the specification).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Has the Examiner established that Claims 1-15 are anticipated under 35 U.S.C. 102(b) or obvious under 35 U.S.C. 103(a) over US Patent 6,350,488 to Lee et al.

VII. ARGUMENT

A. US Patent 6,350,488 to Lee et al. Fails to Anticipate and Fails to Render Obvious Claims 1-15

Claims 1-15 were rejected under 35 U.S.C. 102(b) as being anticipated or under 35 U.S.C. 103(a) as being obvious over US Patent 6,350,488 to Lee et al. al (hereinafter also referred to as "Lee") are not deemed tenable. Lee does not anticipate and does not render obvious the present invention since, among other things, Lee does not even remotely suggest that the diameter of carbon nanotubes could or should be controlled by controlling the residence time of the carbon containing precursor in the reaction chamber.

Example 1 of Lee does not suggest this as urged in the office action. In particular, Example 1, as well as the entire disclosure of Lee, does not even remotely suggest that there exists a causal relationship between residence time control and diameter control. Example 1 merely discusses what was done and then comments on the results but in no way ties the results achieved to residence time control.

In fact, if anything, Lee teaches away from the present invention since the critical aspect of Lee seems to be etching the metal catalyst layer to form isolated nanosized catalytic metal particles evenly distributed over an area of the substrate. This is the aspect of Lee that purports to address prior art problems including control of length and diameter. Therefore persons skilled in

the art would be lead by Lee to use the technique of isolated nanosized catalytic particles not some other parameter to control diameter.

In fact when Lee discusses pressures, such are with respect to the catalytic particles and are selected according to the type of apparatus employed. See column 4, lines 28-33.

In addition to the extent inherency is being relied upon such is misplaced. Inherency requires that the recited results or structure must necessarily be obtained not merely that it might be achieved. See *Electra Medical Systems S.A.* v. *Cooper Life Sciences, Inc.*, 32 USPQ2d 1017 (Fed. Cir. 1994); *In re Oelrich*, 212 USPQ 323 (CCPA 1981) and *In re Robertson*, 49 USPQ2d 1949 (Fed. Cir. 1999).

CLAIMS

A copy of the claims involved in the present appeal is attached hereto as Appendix A. As indicated above, the claims in Appendix A include the amendments filed by Applicant on January 29, 2007.

Please charge any additional fee due with this paper to deposit account 22-0185, under Order No. 20140-00309-US1 from which the undersigned is authorized to draw.

Dated: 11/5/08

Respectfully submitted,

By _____

Burton A. Amernick
Registration No.: 24,852
CONNOLLY BOVE LODGE & HUTZ LLP
1875 Eye Street, NW
Suite 1100
Washington, DC 20006
(202) 331-7111
(202) 293-6229 (Fax)
Attorney for Applicant

APPENDIX A

Claims Involved in the Appeal of Application Serial No. 10/689,675

1. A method for controlling the diameter of carbon nanotubes grown by chemical vapor deposition (CVD) or by plasma enhanced chemical vapor deposition(PECVD) in the range of about 0.2 to about100 nanometers comprising:

introducing a catalyst substrate into a CVD OR PECVD growth reactor;

increasing the growth reactor temperature to a desired growth temperature;

flowing reactive gases including a carbon containing precursor; and

controlling the residence time of the carbon containing precursor in the reactor to control the diameter of the carbon nanotubes.

2. The method of claim 1 wherein the residence time of the carbon containing precursor in the reactor is controlled by establishing a controlled pressure in the reaction chamber and adjusting the gas flow rate of the carbon precursor.

3. The method of claim 1 wherein the residence time of the carbon containing precursor in the reactor is controlled by establishing controlled gas flow rates into the reactor and adjusting the pressure in the reactor.

4. The method of claim 1 wherein the residence time of the carbon containing precursor in the reactor is controlled by adjusting the gas flow rate and the growth pressure of the reactor.

5. The method according to any one of Claims 1, 2, 3 or 4 wherein the growth temperature is about 400 to about 1200°C.

6. The method according to any one of Claims 1, 2, 3 or 4 wherein the catalyst substrate contains transition metal particles.

7. The method according to Claim 6 wherein the catalyst comprises at least one member selected from the group consisting of Fe, Mo, Co, Ni, Ti, Cr, Ru, Mn, Re, Rh, Pd, V and alloys thereof.

8. The method according to any one of Claims 1, 2, 3 and 4 wherein the catalyst substrate have a size about 0.2 nanometers to about 100 nanometers.

9. The method according to any one of Claims 1, 2, 3 and 4 wherein the carbon containing precursor comprises at least one member selected from the group consisting of aliphatic hydrocarbons, aromatic hydrocarbons, carbonyls, halogenated hydrocarbons, silyated hydrocarbons, alcohols, ethers, aldehydes, ketones, acids, phenols, esters, amines, alkylnitrile, thioethers, cyanates, nitroalkyl, alkylnitrate, and mixtures thereof.

10. The method according to any one of Claims 1, 2, 3 or 4 wherein the carbon containing precursor comprises at least one member selected from the group consisting of methane, ethane, propane, butane, ethylene, acetylene, carbon monoxide and benzene.

11. The method according to any one of Claims 1, 2, 3 or 4 which comprises employing a carrier gas along with the carbon precursor.

12. The method of claim 11 wherein the carrier gas comprises at least one member selected from the group consisting of argon, nitrogen, helium, hydrogen and ammonium.

13. The method according to any one of Claims 1, 2, 3 or 4 wherein the flow rate or pressure or both is adjusted such that the residence time in the reactor can be varied from about 1 minute to about 20 minutes, to tune the CNT diameter.

14. The method according to any one of a Claims 1, 2, 3 or 4 wherein the flow rate or pressure or both is adjusted so that the residence time can be varied between about 1.2 minutes to about 10 minutes to tune the CNT diameter.

15. The method according to any one of claims 1, 2, 3 or 4 wherein the diameter of the carbon nanotubes is smaller than the particle size of the catalyst.

APPENDIX B-EVIDENCE

No evidence pursuant to §§ 1.130, 1.131, or 1.132 or entered by or relied upon by the examiner is being submitted.

APPENDIX C-RELATED PROCEEDINGS

No related proceedings are referenced in II. above, hence copies of decisions in related proceedings are not provided.